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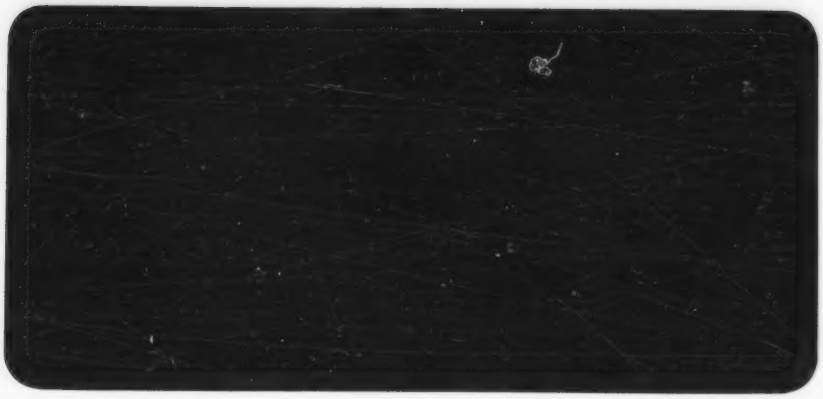

Department of Finance

Fiscal Policy and Economic Analysis Branch

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EFFECTIVE RATES OF ASSISTANCE: AN OLD IDEA WHOSE TIME HAS COME?

by

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ABSTRACT

Despite widespread agreement among industrialized countries to liberalize their economies, as evidenced by the successful conclusion of the Uruguary Round, no accepted indicators exist that would capture the extent of assistance provided to various industries. An exception is the indicator, referred to as the "effective rate of assistance", or ERA, calculated by the Australian Industries Assistance Commission. The paper uses general equilibrium analysis to determine if this indicator would be of use to Canada. Simulations with the GET model, a large 88-sector general equilibrium model of the Canadian economy, suggest that the answer is in the negative. An alternative strategy is to develop separate indicators for major forms of assistance such as the non-tariff barriers, tax expenditure, subsidies, and preferential government procurement.

RÉSUMÉ

Malgré l'assentiment largement répandu parmi les pays industrialisés de libéraliser leur économie, tel que le démontre la conclusion satisfaisante des négogiations de l'Uruguay, aucun indicateur largement accepté de l'importance du soutien accordé aux différentes industries n'existe. Une exception est l'indicateur appelé le taux effectif d'aide, ou TEA, calculé par l'*Australian Industries Assistance Commision*. Cet étude utilise l'approche d'équilibre général pour déterminer si cet indicateur pourrait être utile pour le Canada. Des simulations avec le modèle GET, un modèle d'équilibre général de l'économie canadienne comprenant 88 secteurs, indique que la réponse est négative. Une stratégie de rechange est de développer des indicateurs séparés pour les formes majeures d'aide tels que les barrières non-tarifaires, les dépenses fiscales, les subventions, et les politiques d'achat de l'État.

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1. Introduction

Most countries now accept the need for trade liberalization as underscored by the successful completion of the Uruguay Round of trade talks[1] at the end of 1993. While this is a favourable development, real success in liberalizing economies can only be determined if reasonable indicators are available that can show the extent of assistance provided to domestic industry. Unfortunately, however, no such comprehensive indexes generally exist and the need for developing such indexes can not be underestimated.

One exception to this lack of existence of comprehensive indicators is Australia's indicator referred to as the "effective rate of assistance" (ERA)[2]. According to Plunkett, Wilson and Argy (1992), an ERA is "a single, easy-to-grasp indicator of the net incentive effect of the many different forms of assistance" to industry. More specifically, an ERA separately estimates the assistance provided to industry through all sources and then aggregates all such assistance into a summary statistic. A useful way to conceptualize an ERA is that it is like an ad valorem tariff, except that it is all-encompassing.

If the ERA is indeed such a valuable summary indicator of assistance, it would be of considerable use to countries trying to get a handle on the overall extent of assistance provided through such channels as tariffs, non-tariff barriers, subsidies, tax expenditure and preferential government procurement practices. The OECD has emphasized the need for structural reform in member countries and, as an integral part of this reform process, the need for the development of indicators of structural surveillance[3]. The OECD notes:

> "Appropriate use of quantitative indicators might also strengthen the monitoring of policy reform. While not a substitute for in-depth assessment, simple and objective measures of the costs and benefits of policies and progress towards a more favourable balance might help to guide governments in their reform efforts and to focus public attention on what is at stake".

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1. See Department of Finance (1994)

2. Australia, Industries Assistance Commission (1987).

3. OECD (1989a).

The purpose of this paper is to undertake an analytical review of the ERA concept and to examine its advantages and disadvantages. Specifically, in the context of the potential role of ERAs in enhancing the transparency of industry support, the paper asks three questions:

1. Is the ERA concept theoretically sound?
2. Can meaningful ERA estimates be developed empirically?
3. What contribution can the ERAs make in the process of structural reform?

The theoretical commentary and empirical evidence provided in this paper, in the context of the three questions posed above is, however, totally related to Canada. Any tentative conclusions that emerge from this discussion are, therefore, specific to the Canadian situation and need not apply to other countries.

We should state at the outset that we think of ERAs as a summary indicator consisting of two distinct elements: the first element is the idea of an "effective" rate of protection (ERP) as distinct from the "nominal" rate, a distinction that arises because of the presence of intermediate inputs; and, the second element is an accounting of all forms of "assistance" to industry, such as tariffs, non-tariff barriers, sector-specific subsidies, preferential tax expenditures, and special credit facilities, among others. The distinction between an ERP and an ERA, therefore, is that the former concentrates only on intermediate good use, while the latter includes the former and takes into account all forms of assistance.

The plan of this paper is as follows. Based on the clear distinction we make between the two elements of ERAs, Section 2 briefly summarizes the theory of the "effective" rate of protection (ERP), using tariffs as an example of the assistance provided to domestic industry. Section 3 analyzes the theoretical debate on the soundness of ERPs, and ends with some empirically-verifiable propositions. Section 4 provides empirical analysis to test these propositions using the Department of Finance's large-scale General Equilibrium Trade (GET) model. The theoretical debate identifies that it is exactly such a model that is needed to resolve the fundamental points of disagreement among trade theorists on this debate. Section 5 examines empirical issues related to the key forms of assistance in the particular Canadian context. Section 6 deals with the third of the three questions posed above, and examines the potential contribution of ERAs to the process of structural reform in Canada. Section 7 draws out key conclusions from this analysis.

2. The Theory of the Effective Rates of Protection

The conceptual need for calculating "effective" rates arises because of the existence of intermediate inputs. In the absence of such inputs, rates of nominal tariff, or tariff-equivalents of quantitative restrictions, provide appropriate indication of both the **extent** of protection and the direction of change in **resource allocation** in standard trade models[4].

For example, in the absence of intermediate goods:

(1) $P = P^*(1 + t)$

where P is the domestic price of the imported good, P^* the international price and t the ad valorem tariff rate.

On the **extent** of protection, a 10 per cent nominal tariff (t) on imports implies that the cost of production of the protected good can rise 10 per cent[5], while still keeping the domestic good competitive with imports in the domestic market. On **resource allocation**, the key effect of the tariff is to increase the production of the protected good[6]. Thus, the direction of change in nominal tariff rates accurately reflects the direction of change in resource allocation, under a set of appropriate assumptions.

Things become complicated in the presence of intermediate inputs even in simple trade models: the first effect is that nominal tariffs on final goods do not accurately reflect the extent to which the domestic costs of using primary factors of production can be raised, while still remaining competitive in the domestic market; the second is that it is by no means certain that nominal tariffs encourage the production of protected "final" goods, if intermediate inputs are also taxed. With intermediate goods, nominal tariffs potentially lose the power to predict changes in resource allocation.

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4. The question as to which indicator of protection, nominal or effective, is more relevant for determining the welfare or real income effects of protection is not discussed here. Ethier (1977) has provided proof that, from a welfare-real-income perspective, nominal protection is the appropriate indicator to use. He also argues that the effective rates of protection are likely to be of interest in situations where the objective of the exercise is to determine the income distribution effects of changes in protection.

5. This is true under the simplifying assumptions of homogeneous goods and perfect competition.

6. This is again true of simple trade models that assume constant returns to scale and perfect competition.

These two propositions can be easily demonstrated.

(2) $P_V = P^*(1 + t) - P_i(1 + t_i)\alpha_i$

where P_V is the unit price of value added in producing a commodity, P_i is the unit price of the intermediated input (assume for simplicity only one such input), t_i is the tariff on the intermediated input, and α_i the coefficient of the intermediate input used in the production of the final good.

In this equation t alone does not indicate the extent of protection for the final good; P_i, α_i and t_i are also important. Furthermore, an increase in t may not increase protection for the final good if t_i is raised at the same time.

The concept of the effective rate of protection (ERP) was developed by Johnson (1965), Balassa (1965) and Corden (1966) to deal with this problem of the uncertainty of resource allocation effects of changes in tariffs, in the presence of intermediate inputs. Very simply, ERPs could be thought of as replacing gross output prices by value added prices in calculating the rate of protection. Thus, from equation (2):

(3) $ERP = (P_V/P_V^*) - 1$

where P_V^* is the price of value added in the absence of protection.

Equation (3) for ERP is perfectly symmetric with equation (1) for the nominal rate of protection (NRP), as from (1) we have:

(4) $NRP = (P/P^*) - 1$

Estimating ERPs seems intuitively simple and straightforward: simply replace gross output prices by value added prices and we seem to have an "effective" rate of protection in a world with intermediate inputs, totally symmetric with "nominal" protection in a world without intermediate inputs (as we would see later, this intuition is unfortunately not accurate).

3. Theoretical Debate on Effective Protection

The concept of ERPs, given its apparent simplicity as discussed in Section 2, seemed highly promising in the mid-1960s. By 1973, a considerable debate had taken place on the soundness of the concept. This debate centred around four topics: the role of domestic versus imported intermediate inputs; the feasibility of defining a "price of value added", as in equations (2) and (3) above; the problem of dealing with "non-traded goods"; and, whether ERPs could be calculated using only observed or observable data, or whether there was a need to first solve a general equilibrium (GE) system to develop ERPs. The debate ultimately ended with all parties agreeing on the theoretical weaknesses of the ERP concept, but disagreeing on its empirical usefulness. The key elements of this debate are summarized below.

(i) Domestic vs Imported Intermediate Inputs

This turned out to be the least divisive of all issues as it was quickly realized that the distinction between domestically-produced and imported intermediate inputs was critical: there was no significant need to develop ERPs if intermediate inputs were domestically-produced non-traded goods[7].

It is easy to understand the critical importance of this distinction between domestically-produced non-traded and imported inputs. Consider a good X which goes through a number of stages of production (n-1) using primary factors capital (K) and labour (L), and intermediate inputs (Z) at each stage.

$$(5) \qquad X_j = X_j(K_{xj}, L_{xj}, Z_{xj}) \qquad j = 2, \text{----- } n$$

Similarly we can specify the production function for Z, also going through n-1 stages of production as

$$(6) \qquad Z_{xj} = X_i \qquad i = j - 1$$

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7. For example, Bhagwati and Srinivasan (1983), using an example of automobile production with or without imported steel, argue: "In the absence of any imported intermediate goods, such as steel, the nominal tariff on automobiles would have indicated accurately the protective effect on automobiles".

In equation (5), product X at the stage of production j is produced using primary factors K_{Xj} and L_{Xj} and an intermediate input Z_{Xj}. If a tariff is imposed on the imports of X_j, one can calculate an ERP using the formula in equation (1). If all intermediate inputs are imported, i.e. equation (6) does not exist, the ERP thus calculated would indicate the extent of protection provided primary factors K_{Xj} and L_{Xj} at the only available stage of domestic production. However, if Z_{Xj} is not imported but domestically produced, then the set of equations (6), for all stages of production, can be substituted into equation (5) to get:

$$(7) \qquad X = X(K_X, L_X)$$

Very simply, what has happened is that the primary factors used at every stage of production have been combined to explain the production of the final good -- in this process of substitution, domestically-produced intermediate inputs completely disappear, leaving only primary factors in the production function. The concept of nominal protection is thus sufficient to capture the protection provided domestic primary factors in such a case. This argument is strengthened by the further argument that any division of the production process for a final good into various stages can be totally arbitrary; thus an ERP for any one stage may have no meaning.

This discussion, therefore, leads us to the view that a critical empirical issue in determining the practical importance of ERPs is to determine the importance of domestic non-traded intermediate inputs in the production process.

(ii) Defining a "Price of Value Added"

Leith (1968) has demonstrated that, to be symmetric with nominal protection, the ERP should be based on a price of value added as in equations (2) and (3) above. However, he also shows that such a symmetric price concept in the presence of intermediate inputs does not normally exist as it is generally not possible to think of value-added as a distinct good with its own price, symmetric with a final good with its own price. If the value added component of a final good (per unit of output) can change significantly after the imposition of a tariff, it would not be possible to determine what this fictional value added commodity is. Given this, it is not certain what its per unit price is. And, if such a per unit price can not be determined, it would then not be possible to determine how it changes in response to a change in protection. It also seems clear that if production technology was indeed such that the value-added component of a final good could be clearly defined, it would be possible to define its price and calculate its ERP. The class

of production technology falling into this category, where the definition of a precise value-added commodity is feasible, is referred to as "separable production functions".

One can not, in general, expect all production technology to be of this "separable" form. If this assumption does not hold, equations such as (2) and (3) above can not be defined. An alternative definition of ERPs -- represented by ERP1 below -- was proposed by Anderson and Naya (1969) and Corden (1969):

(8) $ERP1 = (U/U^*) - 1$

where U and U* are unit value added with and without a tariff.

The difference between (8) and (3) is that no effort is made in (9) to determine precisely what a value-added commodity or its price is. If production technology was indeed "separable", then U and P_V would be identical, and (3) and (8) would be exactly the same.

(iii) The Problem of Dealing with Non-Traded Goods

The use of ERP1 as a measure of protection in the presence of intermediate inputs adds another complication in the presence of goods that are not traded. In general, unit value added can be defined as:

(9) $U = \Sigma\, r_i\beta_i \qquad i = 1, \ldots m$

where r_i are the rewards, and β_i input-output coefficients, for the m primary factors of production.

Any changes in tariffs on traded goods, that have absolutely no direct bearings on non-traded goods, would however change relative factor rewards[8] (the r_i) and β_i, if production functions are not of the Leontief-type, and thus change U. Using an equation like (8) to estimate ERPs can erroneously suggest changes in the level of protection for non-traded goods, even when such protection has no logical meaning. What we would see in such situations is a seemingly perverse relationship between this estimated protection for such commodities and their production

8. This follows from the Stolper-Samuelson theorem.

levels: for example, as prices for these goods go up in response to cost increases, their production falls due to declining demand.

(iv) Partial Equilibrium vs General Equilibrium Effective Rates of Protection

Bhagwati and Srinivasan (1983) asked another key question in the context of ERPs.

> "One more dimension of the problem, which does not exist with nominal tariff theory, is the following: can such an index (of ERPs) be measured from observed or observable data without the need to solve the general equilibrium (production) system for the two situations between which the resource-allocational shift is being predicted? If it cannot be, the (ERP) index will not be of practical value, because to compute it one will have to solve the full system and will thus already know the shift in value added brought about by the tariff structure".

Estimating U in equation (8) without simulating a GE system is feasible only if the form of production functions is severely constrained. In general, "separable" production functions are not enough to guarantee this, unless further restrictions are imposed on their form (e.g. homogeneity of degree 1). Bhagwati and Srinivasan (1983) argued:

> "The answer is not helpful to the proponents of the ERP theory, for even the use of separability assumptions will not suffice, in general, to allow one to calculate the 'price' of value added, when noninfinitesimal tariffs are involved, without first having to solve for the resource-allocational effects of the protective tariff structure in general equilibrium".

Leontief-type production functions satisfy these constraints. These constraints assure that the unit value-added remains invariant to changes in protection. In the absence of such constraints, a proxy for equation (8) can be used to estimate ERPs. This proxy (ERP2), in general, turns out to be:

(10) $ERP2 = (U/(U-A)) - 1$

where A is the level of assistance provided.

This proxy thus sidesteps the issue of comparing two solutions -- one related to pre-tariff-change, and the other to post-tariff-change, situations. Instead, equation (10) relies on what Bhagwati and Srinivasan call the "observed or observable" data.

If the required production function constraints are not satisfied in reality, then ERP2 proxies of equations (2) and (3) would not likely be adequate and the calculation of ERPs and their resource allocation effects become a chicken and egg problem: workable ERPs can not be determined without using a GE model, but if we have a GE model there may be no need to calculate ERPs[9].

(v) An Example

We have constructed a simple example to illustrate the theoretical points made above (Table 1).

Three scenarios are provided. In each scenario, the nominal rate of tariff on gross output is assumed to increase 5 percentage points, with no change in any other tariffs or subsidies, including those on intermediate inputs. The three scenarios can be distinguished on the basis of differences in production technology. These are:

1) Following Leontief, the use of the intermediate input per unit of gross output remains unchanged[10].

2) An increase in the price of the final good makes this good more intensive in the use of the intermediate good, and thus less intensive in the use of value-added.

3) An increase in the price of the final good makes this good less intensive in the use of the intermediate good, and thus more intensive in the use of value added. An

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9. Other important criticisms of the ERP concept emerged from Baldwin (1970), Ethier (1971), Guisinger and Schydlowsky (1970) and Travis (1968). On the other hand, Balassa (1971) provides a long list of uses of ERPs and argues that, despite theoretical reservations expressed by a number of contributors on the topic, the concept remained empirically valuable. Not much new work has been undertaken on ERPs since the mid-1970s, however. In the most comprehensive paper published on effective protection to-date Bhagwati and Srinivasan (1973) concluded: "... the vast empirical effort required in making up the ERP numbers seems grossly disproportionate to what can be done to predict actual resource allocational impacts of the tariff structure..."

10. The "separability" condition alone is not sufficient to allow the calculation of ERPs by using only observed data.

extreme case is provided where the use of the intermediate good totally disappears[11].

The following information is provided: gross output in Row 1; intermediate good in Row 2; value-added -- that is gross output stripped of its intermediate component -- in Row 3; unit-value ERP estimates[12], ERP1, along the definition contained in equation (9) in Row 4; the level of assistance in Row 5; value-added minus assistance in Row 6; and, finally, ERP2, another proxy for ERPs, based only on "observed" data, in Row 7.

As an example, in Scenario 1, a 5 percentage points increase in nominal tariff on the final good leads to a 5 per cent increase in the price of gross output from 1 to 1.05. With a Leontief production function, the use of the intermediate input remains unchanged at 0.648. Value-added per unit of output rises to 0.402. ERP1 rises from 13.6 to 29.7 per cent (.402/.310). The new level of assistance is 0.092 (0.042 + .05). The new value added minus assistance is 0.310 (the same as in the Base Case) and the new ERP2 is also 29.7 per cent (.092/.310).

The following simple observations can be made on the basis of the information provided for these scenarios.

1. Theoretically, ERP1 is the ideal measure to use, as it represents the change in the price of value added, if the production function is Leontief-type, as in Scenario 1. ERP1 rises by 16.1 percentage points to 29.7 per cent in response to a 5 percentage points increase in the tariff on the final good. The ERP 2 measure provides an appropriate estimate of ERP1, which eliminates the needs for developing and simulating a GE model.

2. In the absence of production function constraints, ERP2 proxies would not provide reasonable indicators of protection. In this example, an increase in the tariff on final goods, in the presence of

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11. This is not as far-fetched as it may seem. Remember that ERPs only make sense if intermediate inputs are imported (see Section 3(i)). This scenario could be considered as indicating that an imported intermediated good begins to be produced domestically following an increase in tariff on the final good.

12. ERP1 estimate is obtained as (.352/.310) -1. The implicit assumption is that assistance (in Row 5) is being provided to the final good only. This simplifies the discussion considerably without any loss in information.

intermediate inputs, reduces ERP2 from 13.6 per cent in the Base Case to 9.6 per cent in Scenario 3, a perverse relationship.

Table 1
Impacts of a 5 Per Cent Nominal Tariff Increase
An Example of Alternative Estimates of the Effective Rate of Protection

	Base Case	Unit Value in the Three Scenarios			Percent Changes in Outputs in Three Scenarios		
		(1)	(2)	(3)	(1)	(2)	(3)
(1) Gross Output	1	1.05	1.05	1.05	30	30	30
(2) Intermediate Good	0.648	0.648	0.713	0.00	30	36	-100
(3) Value Added	0.352	0.402	0.337	1.05	30	19	369
(4) ERP1	13.6	29.7	8.7	339	-	-	-
(5) Assistance	0.042	0.092	0.092	0.092	-	-	-
(6) Value Added Minus Assistance	0.310	0.310	0.245	0.958	-	-	-
(7) ERP2	13.6	29.7	37.6	9.6	-	-	-

3. ERP1 can itself move around considerably, sometimes even perversely, when production technology constraints are not imposed. In Scenario (2), ERP1 falls 4.9 percentage points to 8.7 per cent, following a 5 percentage points increase in tariff on the final good -- again a perverse relationship. On the other hand, in Scenario 3, ERP1 rises more than 300 percentage points, from 13.6 to 339 per cent, as a result of a large decline in the use of the intermediate good.

4. Both ERP1 and ERP2 are inappropriate indicators of resource allocation. It is arbitrarily assumed in Scenarios 1 to 3 that gross output rises by 30 per cent in response to the increase in tariff on the final good. Rows 2 and 3 provide estimates of the effects on intermediate goods and value added. It is, in general,

hard to see the relationships between changes in ERPs and output: the decline in ERP1 in Scenario 2 occurs at the same time that there is an increase in value added of 19 per cent. Similarly, a decline in ERP2 in Scenario 3 occurs at the same time that there is a large increase of 369 per cent in value added.

5. Both ERP1 and ERP2 are poor indicators of changes in gross output, a decline in ERP1 in Scenario 2 is consistent with a 30 per cent increase in gross output in Scenario 2; a decline in ERP2 in Scenario 3 is also consistent with a 30 per cent increase in output in Scenario 3.

6. These examples were developed arbitrarily. They seem to suggest -- and only suggest -- that the most useful of the tariff estimates may be the nominal rate: an increase in the nominal rate, at least, goes in the same direction as the increases in gross output and value added.

These examples lead to three key results.

1. Proxies of effective protection may not be good indicators of the extent of actual protection. If this indeed is the case, then one can conclude that dispersions in the proxies of effective protection may not be good indicators of the dispersion of the extent of actual protection.

2. Proxies of effective protection may not be good predictors of changes in resource allocation.

3. A calculation of the effective rates of protection in a general equilibrium system may not improve matters much. Thus, there may be situations where there are no substitutes for directly studying the resource allocation effects of changes in protection using a GE model: unfortunately, as the examples presented above demonstrate, it may not be possible to determine a priori the circumstances under which the development and use of a GE model could or could not be avoided to study resource allocation effects.

The discussion in this section has been more conceptual than empirical. This discussion demonstrates that there exist potentially serious theoretical problems with the ERP concept. However, the question remains how empirically serious these concerns are. For this purpose, one

needs to actually develop alternative estimates of ERPs for a particular economy. To this we now turn our attention using the Canadian data.

4. Effective Rates of Protection for Canada Using a General Equilibrium Model

The theoretical discussion above leads to four empirically-verifiable propositions on the usefulness of ERPs.

(a) As ERPs are most meaningful in the presence of imported inputs, what is the importance of such inputs in the Canadian context?

(b) Is it possible to develop "value added prices": in other words, is the assumption of "separable production functions" realistic?

(c) What is the relationship between nominal tariff rates, ERP2s using "observed" data, and ERP1s using general equilibrium simulation data? Are ERP estimates, developed on the basis of observed data alone, representative of general-equilibrium ERP estimates?

(d) What is the relationship between these various concepts of protection and the direction of change in value added and gross output?

These four propositions are examined below using both the data-base, and simulations, of the 88-sector Department of Finance General-Equilibrium Trade (GET) model of the Canadian economy.[13] The theoretical foundation of the model is based on Cox and Harris (1985), Cox and Harris (1986), and Harris (1984).

(i) Import Content

Table 2 provides a summary of the import content of 88 gross outputs used in GET for the Canadian economy. It is difficult to draw any strong conclusions from these data. It seems, however, that only a few select industries rely heavily on imported intermediated goods. For

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13. This model was originally developed to examine the impact of Canada-United States Free Trade Agreement. A non-technical description of the model can be found in Department of Finance (1988). A technical description of GET is available in Harris (1988).

instance, only 9 of 88 industries have an import content of 30 per cent or more. This information does not provide overly strong justification for calculating ERPs[14].

Table 2
Import Content of Canadian Gross Outputs

Import Content Over:	Number of Industries Out of 88
50 per cent	0
40 per cent	4
30 per cent	9
20 per cent	20
10 per cent	50
Memorandum Item	
Average import content (%)	9.6

(ii) Production Technology in Canada

As part of the development of the General Equilibrium Trade (GET) model, the Department of Finance undertook a considerable amount of work on the nature of production functions of 147 highly disaggregated Canadian manufacturing industries and estimation of price elasticities for imported goods for 70 commodities[15]. The following results of this analysis are relevant for the debate on the usefulness of ERPs.

- While the hypothesis of "Leontief-type or separable" production functions was not specifically tested, the estimated production functions do not show any of these properties.

- The large majority of industries show increasing returns to scale. In combination with the existence of imperfect competition, the actual Canadian production

14. An additional difficulty we face is that the theoretical argument is dependent upon intermediate inputs being non-traded. Intermediate inputs that are domestically produced but are importable would continue to face internationally-set prices, so that the concept of effective rate remains relevant in such situations.

15. See Robidoux and Lester (1988) and Létourneau and Lester (1988).

structure is remarkably different from the traditional-trade-theory model of perfect competition and constant returns to scale. In the absence of these two standard assumptions, the relationship between trade restrictions and resource allocation becomes considerably more complicated.

- The estimation of price elasticities for imported goods reveals that these elasticities are far from being infinite -- indicating the existence of differentiated products. This creates a problem for the calculation of ERPs as international prices of comparable goods do not exactly reflect the prices of Canadian goods. Thus, differences in these prices may reflect differences in the characteristics of these goods rather than protection.

These characteristics of the estimated Canadian production structure are in the tradition of Krugman (1979) and Helpman (1981). These specific characteristics can have the following important implications for the estimation of ERPs.

- Value-added prices as required by equations (2) and (3) can not be defined: hence, no neat, easily-understandable and easily-defensible estimates of ERPs can be prepared.

- There is no simple relationship between protection and resource allocation. Even reductions in nominal tariffs on some products may increase their production[16]. For example, a reduction in tariffs could encourage domestic oligopolist producers to enhance production levels in an effort to reduce the cost of production (with increasing returns to scale) to remain competitive with imported goods.

- Changes in factor prices brought about by changes in some tariffs would change unit value added even for products that are not directly affected by tariff changes. Using equation (9) to estimate ERPs would indicate changes in effective protection in such cases. Such problems do not occur in simple theoretical models because of

16. In Section (3), we identified the conditions under which ERPs could perform a role similar to that of nominal tariffs in the presence of intermediate inputs in indicating the extent of protection and in suggesting the change in resource allocation. The new trade theory literature, which is the basis for the GET model, suggests that even estimates of nominal protection may be devoid of any information content in suggesting resource allocation effect. If this indeed is the case, then the whole exercise of developing ERP estimates in the presence of intermediate goods that are consistent with, and as useful as, nominal protection loses much of its rationale.

the assumption of homogeneous goods. In the GET model, we have differentiated goods (that create a problem very similar to that for non-traded final goods discussed in Section 3 (iii)).

(iii) Relationship Between Various Concepts of Protection

Table 3 provides estimates[17] of nominal rates of protection and ERP2 estimates of effective rates of protection for the 88 industries in the GET model. Substantial differences in nominal and effective rates can be noticed in particular cases: for example, wineries have an effective rate of 1000.01 per cent, almost 17 times the nominal rate of 57.45 per cent. On the other extreme, mixed fertilizers have a small positive nominal rate of 0.16 per cent and a large negative effective rate of 6.82 per cent.

Despite these observations, there is, in general, a very high correlation between nominal rates and ERP2s: the Pearson correlation coefficient between the two is 0.75, while the Spearman rank correlation coefficient is 0.91. In general, one can conclude from these estimates that nominal rates are good indicators of ERP2s. This observation is consistent with Baldwin's (1984) who comments[18]:

> "Fortunately, the entire issue is not very important as a practical matter, since there is generally a high degree of correlation between nominal and effective rates".

We ran a counter-factual experiment with the GET model to study the links between changes in general equilibrium ERPs (ERP1s), ERPs based only on observed data (ERP2s), and nominal tariffs: nominal tariff rates were arbitrarily raised 5 percentage points on randomly-selected 31 of the 88 industries in the GET model.

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17. It needs to be emphasized that these estimates are pre FTA/NAFTA rates and thus bear no relationship to the current actual rates of protection or what these rates would be when the FTA/NAFTA are fully in force. The fact that the protection rates presented are not current is of no major consequence for this study whose sole purpose is illustrative. Updating the model to calibrate the current data to current protection rates was not attempted as such a major exercise was not required given the focus of this study.

18. Corden (1969) also finds similar results. However, Balassa (1971) has observed smaller correlation coefficients for some countries.

Table 3
A Comparison of Nominal and Effective Rate of Protection (ERP2)

Industry	Nominal Rate	ERP2
MIXED FERTILIZERS	0.16	-6.82
REPAIR CONSTRUCTION	0.00	-5.68
RES. CONSTRUCTION	0.00	-5.40
AGRIC.MACH.& EQ.	0.60	-4.94
NON-RES. CONSTRUCTION	0.00	-4.40
MEAT PRODUCTS	1.97	-3.26
FOOD & ACCOMODATION	0.00	-2.45
MOTOR VEH. PARTS	1.31	-2.42
OTH.PETROLEUM & COAL	0.84	-2.08
FISHING AND HUNTING	0.25	-1.47
OTHER MINING	0.23	-1.45
METAL MINING	0.09	-1.37
FORESTRY	0.03	-1.21
TRUCK TRANSPORTATION	0.00	-1.17
AIR TRANSPORTATION	0.00	-1.07
OTH.TRANSP. & STORAGE	0.00	-0.93
AMUSEMENT & RECREA.	0.00	-0.84
RAIL TRANSPORTATION	0.00	-0.83
PERSONAL & MISC.SERV.	0.00	-0.66
RETAIL TRADE	0.00	-0.57
OTHER UTILITIES	0.00	-0.55
WHOLESALE TRADE	0.00	-0.53
COMMUNICATIONS	0.00	-0.50
HEALTH AND EDUCATION	0.00	-0.48
BUSINESS SERVICES	0.00	-0.34
F.I.R.E.	0.00	-0.30
ELECTRIC POWER	0.00	-0.13
ALUM.ROLL.CAST.& EXT.	1.44	-0.13
OWNER DWELLING	0.00	-0.00
PETR. & GAS WELLS	0.29	0.19
MOTOR VEHICLES	2.94	1.16
SAWMILLS	1.27	1.98
PETROLEUM REFINERIES	0.53	2.00
PULP AND PAPER	1.88	2.11
PRINTING & PUBLISH.	2.52	2.79
SMELTING & REF.	1.53	3.10
AGRICULTURE	3.03	3.38
OTH.MET.ROLL.,CA.& EX	2.44	3.71
COM.RE.,OF.& S.E.	4.73	4.52
AIRCR.& A. PARTS	4.56	5.53
OTHER WOOD PRODUCTS	3.64	5.82
PHARMACEUTICAL	4.74	6.85
ENGRAVING & STEREOTY.	5.94	7.21
FISH PRODUCTS	3.33	7.27
VEN.,PLYW.,SA.& DOOR	4.61	7.62
INDUS.& OTH.CHEMICALS	5.13	9.18
CEMENT AND CONCRETE	5.95	10.15
HARDWARE AND CUTLERY	7.63	10.61
IND. MACH. & EQUIP.	7.45	10.76
DISTILL. & BREWERIES	7.58	10.86
WIRE & WIRE PRODUCTS	7.61	10.90

OTHER TEXTILES	9.59	11.15
BOILER AND PLATE	8.35	11.15
CONFECTIONARY PROD.	5.61	11.23
GRAIN PRODUCTS	4.74	11.54
SCIENT.& PROF. EQUIP.	7.47	11.57
OTH.METAL FABRICATING	7.76	11.68
OTH.NON-MET.MIN.PROD.	6.77	11.71
ELECTR. INDUS. EQUIP.	8.68	13.20
SMALL ELEC. APPL.	8.20	13.42
FABRIC.STRUCT.STEEL	8.74	13.98
SHIPBUILDING	10.13	14.27
OTH. TRANSP. EQUIP.	8.96	14.44
GLASS & GLASS PROD.	9.25	14.71
LARGE ELEC. APPL.	9.23	15.03
IRON AND STEEL	7.07	15.28
MISCELL.MANUFACTURING	8.01	15.61
COMMUNICATION EQUIP.	11.16	16.08
OTHER ELECTR. PROD.	7.79	16.98
RUBB. & RUBB. PROD.	9.76	17.61
METAL STAMPING	7.95	18.12
LEAT.& OTH.LEAT.PRO.	9.69	21.16
HOUSEHOLD CHEMICALS	9.28	22.97
FURNITURE	12.66	24.45
MISCELL. FOOD PROD.	8.69	24.72
FRUIT AND VEG. PROD.	10.07	25.68
PLASTIC & SYNTH. RES.	8.14	25.98
OTHER PAPER PRODUCTS	9.24	27.27
SYNTHETIC TEXTILES	13.61	27.30
STEEL PIPE & TUBE	10.47	29.66
YARN AND CLOTH	17.91	42.34
DAIRY PRODUCTS	9.61	47.72
LEATHER FOOTWEAR	20.69	49.22
TOBAC. & TOBAC. PROD.	16.51	56.87
POULTRY PRODUCTS	10.81	60.08
KNITTING MILLS	28.12	72.97
CLOTHING	37.83	114.10
WINERIES	57.45	1000.01

Table 4 summarizes the information on estimates of **changes** in nominal rates, ERP1s and ERP2s for the 88 industrial commodities with the help of correlation coefficients. Table 5 provides all the detailed effects of this shock. One can notice cases of both similarity and large differences for changes in these indicators of protection. Two estimates are provided for correlation, one for the change and the other for the new levels of the rates of protection. The table shows that all estimates of protection are highly correlated, both in terms of changes and the post-shock new levels.

Table 4

Correlation Coefficients Between Various Concepts of Protection

	ERP1	ERP2
Changes in Rates (Pearson)		
Nominal Rate	0.79	0.90
ERP1 -	0.84	
Changes in Rates (Spearman)		
Nominal Rate	0.71	0.83
ERP1	-	0.71
Levels of Rates (Pearson)		
Nominal Rate	0.76	0.95
ERP1	-	1
Levels of Rates (Spearman)		
Nominal Rate	0.91	0.91
ERP1 -	0.93	

(iv) Estimates of Various Concepts of Protection and their Relation to Value Added and Gross Output

Finally, the GET model simulation of a 5 percentage points increase in nominal tariffs on some imports can shed light on the usefulness of various concepts of protection in predicting changes in value added and gross output.

Table 5
A Comparison of The Changes in Nominal and Effective Rate of Protection

Industry	Change in Nominal Rate	Change in ERP1	Change in ERP2
OTH.MET.ROLL.,CA.& EX	0.00	2.84	-8.75
METAL STAMPING	0.00	2.71	-7.02
MOTOR VEHICLES	0.00	2.00	-4.59
WIRE & WIRE PRODUCTS	0.00	2.22	-4.32
FABRIC.STRUCT.STEEL	0.00	2.10	-3.96
MISCELL.MANUFACTURING	0.00	1.84	-3.48
OTHER ELECTR. PROD.	0.00	2.02	-3.09
OTH.METAL FABRICATING	0.00	1.84	-2.86

HOUSEHOLD CHEMICALS	0.00	1.34	-2.71
MOTOR VEH. PARTS	0.00	1.59	-2.65
AGRIC.MACH.& EQ.	0.00	1.71	-2.55
BOILER AND PLATE	0.00	1.79	-2.37
IND. MACH. & EQUIP.	0.00	1.93	-2.13
SMALL ELEC. APPL.	0.00	1.90	-2.09
LARGE ELEC. APPL.	0.00	2.29	-2.07
FOOD & ACCOMODATION	0.00	1.15	-1.95
OTH. TRANSP. EQUIP.	0.00	1.79	-1.86
OTH.PETROLEUM & COAL	0.00	1.89	-1.78
RES. CONSTRUCTION	0.00	1.52	-1.76
HARDWARE AND CUTLERY	0.00	1.51	-1.66
REPAIR CONSTRUCTION	0.00	1.48	-1.64
OTH.NON-MET.MIN.PROD.	0.00	1.27	-1.44
ELECTR. INDUS. EQUIP.	0.00	1.71	-1.42
SHIPBUILDING	0.00	1.66	-1.41
SCIENT.& PROF. EQUIP.	0.00	1.31	-1.35
AIRCR.& A. PARTS	0.00	1.66	-1.18
MIXED FERTILIZERS	0.00	1.01	-1.17
PHARMACEUTICAL	0.00	1.46	-1.15
AGRICULTURE	0.00	1.01	-1.08
GLASS & GLASS PROD.	0.00	1.07	-1.04
PLASTIC & SYNTH. RES.	0.00	0.90	-1.03
NON-RES. CONSTRUCTION	0.00	1.50	-0.96
COM.RE.,OF.& S.E.	0.00	1.65	-0.69
COMMUNICATION EQUIP.	0.00	1.52	-0.59
INDUS.& OTH.CHEMICALS	0.00	1.03	-0.56
OTHER MINING	0.00	1.06	-0.54
CEMENT AND CONCRETE	0.00	1.36	-0.45
TRUCK TRANSPORTATION	0.00	0.94	-0.40
AMUSEMENT & RECREA.	0.00	0.96	-0.38
FORESTRY	0.00	1.14	-0.34
METAL MINING	0.00	1.04	-0.34
FISHING AND HUNTING	0.00	0.97	-0.32
PETROLEUM REFINERIES	0.00	5.26	-0.28
WHOLESALE TRADE	0.00	0.91	-0.27
RETAIL TRADE	0.00	0.91	-0.26
PERSONAL & MISC.SERV.	0.00	0.93	-0.26
OTH.TRANSP. & STORAGE	0.00	0.93	-0.21
F.I.R.E.	0.00	0.91	-0.17
BUSINESS SERVICES	0.00	0.89	-0.16
OTHER UTILITIES	0.00	0.89	-0.15
RAIL TRANSPORTATION	0.00	0.97	-0.15
AIR TRANSPORTATION	0.00	1.06	-0.13
HEALTH AND EDUCATION	0.00	0.85	-0.13
COMMUNICATIONS	0.00	0.89	-0.11
PETR. & GAS WELLS	0.00	0.88	-0.10
ELECTRIC POWER	0.00	0.85	-0.05
OWNER DWELLING	0.00	0.81	0.00
ENGRAVING & STEREOTY.	5.00	1.11	6.65
PRINTING & PUBLISH.	5.00	1.46	6.94
KNITTING MILLS	5.00	1.90	6.98
LEATHER FOOTWEAR	5.00	1.75	7.15
CLOTHING	5.00	1.84	7.33
DISTILL. & BREWERIES	5.00	1.29	8.15
FURNITURE	5.00	1.82	8.39
OTHER TEXTILES	5.00	1.89	8.98

STEEL PIPE & TUBE	5.00	3.35	9.02
YARN AND CLOTH	5.00	1.68	9.11
OTHER PAPER PRODUCTS	5.00	2.10	9.20
LEAT.& OTH.LEAT.PRO.	5.00	1.72	9.48
VEN.,PLYW.,SA.& DOOR	5.00	1.94	9.75
PULP AND PAPER	5.00	1.72	10.08
SYNTHETIC TEXTILES	5.00	1.39	10.30
ALUM.ROLL.CAST.& EXT.	5.00	3.50	10.30
OTHER WOOD PRODUCTS	5.00	1.77	10.50
IRON AND STEEL	5.00	1.65	10.97
CONFECTIONARY PROD.	5.00	1.63	11.08
WINERIES	5.00	1.71	11.36
RUBB. & RUBB. PROD.	5.00	0.96	11.65
SAWMILLS	5.00	1.88	11.73
TOBAC. & TOBAC. PROD.	5.00	2.42	12.44
FISH PRODUCTS	5.00	1.90	12.76
FRUIT AND VEG. PROD.	5.00	2.30	13.64
MISCELL. FOOD PROD.	5.00	2.21	14.10
SMELTING & REF.	5.00	2.03	15.39
DAIRY PRODUCTS	5.00	3.31	22.83
POULTRY PRODUCTS	5.00	2.95	23.56
GRAIN PRODUCTS	5.00	4.00	23.93
MEAT PRODUCTS	5.00	4.36	26.91

Table 6 below provides a summary of the correlation coefficients for changes in protection and production[19]. Two sets of estimates are presented: one under the assumption that all production functions are constrained to satisfy the assumption of constant returns to scale; the second which accepts estimated values of the economies of scale that actually exist in the model.

These results show that the power of all tariff indicators to predict changes in resource allocation is quite weak: nominal tariff rates are the best indicator under the assumption of constant returns to scale, while the ERP1 indicator is the least reliable. When the assumption of constant returns to scale is dropped, replaced by the estimated economies of scale in the model, the correlations between all indicators of protection and changes in value added and gross output turn negative: thus, indicators of changes in tariffs can not even be relied upon to predict the overall direction of change in resource allocation. This is not surprising given the combination of factors that underly the theoretical paradigm of the production structure of the GET model: increasing returns to scale, differentiated products, and imperfect competition (see Section 4 (ii) for details).

19. These results are, in general, consistent with the findings of Evans (1972), the only other study to estimate "general equilibrium" ERPs that we are aware of.

Table 6

Correlations Coefficients Between Various Concepts of Protection and Value Added and Gross Output

1. Under the Assumption of Constant Returns to Scale

Pearson Correlation	Value Added	Gross Output
Nominal Tariffs	0.40	0.39
ERP1	0.03	0.00
ERP2	0.35	0.34
Spearman Rank Correlation		
Nominal Tariffs	0.79	0.75
ERP1	0.15	0.06
ERP2	0.79	0.78

2. Under the Assumption of Economies of Scale

Pearson Correlation	Value Added	Gross Output
Nominal Tariffs	-0.13	-0.16
ERP1	-0.49	-0.51
ERP2	-0.05	-0.07
Spearman Rank Correlation		
Nominal Tariffs	-0.51	-0.55
ERP1	-0.77	-0.75
ERP2	-0.45	-0.39

5. Issues in the Context of Various Forms of Assistance to Business

As mentioned in the introduction, we think of ERAs as summarizing two types of information: "effective" protection and a wide range of assistance provided business. This range includes tariffs (discussed above), non-tariff barriers (NTBs), tax expenditure, subsidies and a variety of other assistance forms. This section summarizes key empirical issues in quantifying some of the key forms of assistance.

(i) Non-Tariff Barriers

NTBs, by definition, are non-price barriers that rely on quantity controls in one form or another. Their estimation creates three fundamental problems:

- The conversion of quantity constraints into price differentials -- or tariff-equivalents -- necessitates the specification and estimation of price-quantity relationships. This implies that this conversion would necessarily be "model-dependent": unless the underlying price-quantity models are standardized, there is the possibility of obtaining a wide range of estimates of the tariff-equivalence of NTBs. This can create serious problems of interpretation and comparison of such measures, particularly if they are subsumed as small items in a broader measure such as the ERA. In view of the growing importance of NTBs, making them a small and invisible item in calculating ERAs could send a wrong signal regarding their importance;

- There is no unique list of NTBs that one could quantify. It is hard to "draw a line" between what restrictions should or should not be included in NTBs. Is increased inspection time at the customs an NTB? How about different languages on labels? How about different currencies that create uncertainty in international trade, given uncertainty about changes in their relative values? Is an explicit NTB always more damaging than freely floating exchange rates that may bias production decisions against tradeables, and in favour of non-traded goods, by creating such uncertainty?

- Finally, economic theory suggests that the economic impacts of NTBs -- even when they can be accurately and correctly identified and precisely estimated -- are likely to be very different from those of tariffs in a wide range of situations: for example, a fixed quantitative restriction on imports is dynamically more restrictive than a comparable tariff in the presence of economic growth[20].

Given these difficulties, the issue arises whether it is not more useful to study NTBs separately, than integrate them as part of the ERAs.

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20. See, Rodriguez (1974), Pelcovits (1976), Dasgupta P. and J. Stiglitz (1977). Adding the tariff-equivalent values of NTBs to other forms of protection may be like adding apples and oranges.

(ii) Tax Expenditures

The tax system plays an important part in influencing an economy. Given the importance of the tax system, in comparison with border measures, it would not be unreasonable to claim that taxes are likely to have a much bigger impact on resource allocation in the economy than border measures. However, it is not the total tax burden that influences the structure of production: it is the special provisions of the tax system affecting various sectors. For this reason, tax expenditures are likely an important element of government policies providing assistance to business.

There are a range of problems in estimating tax expenditures, however. Given these problems, it is not obvious that estimates of tax expenditures can be developed to everybody's satisfaction. If such estimates can not be developed satisfactorily, what then is the value of ERAs with or without estimates of tax expenditures? Some of the major problems in preparing tax expenditures are described below[21].

- It is not conceptually clear what "tax expenditure" is. To estimate assistance through the tax system, one needs to know what the "benchmark", "basic", "normal", or "generally accepted" tax structure is -- all these terms have been used in the literature implying different things to different people.

- Even if one agrees on the definition of tax expenditure, there is no unique way of estimating it. Three methods have generally been used in the OECD countries. The first is to measure the revenue foregone; the second is to measure the revenue that would be gained if the particular tax provision was abolished, taking into account changes in behaviour; and, finally, tax expenditure can be measured in terms of outlay equivalents, taking into account the fact that most receipts from budgetary expenditure programs would be taxed in the hands of the recipients, so the revenues foregone from tax expenditures should be "grossed up" according to the recipient's tax rates.

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21. The reader is referred to Bruce (1988) for a thorough discussion of the issues.

(iii) Subsidies

Subsidies are more transparent than tax expenditures and suffer from fewer conceptual problems. However, they also face the difficulty, as do tax expenditures, on "where to draw the line". While it is agreed that generally available subsidies do not distort production, it is not clear what a "generally available subsidy" is. Do subsidies to all industries in a particular region come under this category? Does the answer change if this region is a one-industry region?

(iv) Other Assistance Measures Affecting Trade

The list of measures that can affect trade can be endless. It could include such things as artificially-pegged exchange rates, government procurement, health and safety standards, technical standards, government loan guarantees, income stabilization programs, R&D expenditures and environmental policies, to name a few.

6. ERAs and the Process of Structural Reform: Some Thoughts

One can think of the process of structural reform as policy change in one of two directions that are not mutually exclusive: one may focus either on a particular policy area to make it less distorting for all industries; or, alternatively, one may want to focus on particular industries that face the most distortion and adjust a whole range of policies only for those industries.

The concept of ERAs is more useful if the focus of the reform exercise is on industries rather than on policy areas. This is because ERAs sum up the distortions caused by a wide range of policy areas for a number of industries. These distortions could be offsetting for a number of industries, with ERAs indicating no cause for concern, and small and re-enforcing for other industries, with ERAs suggesting need for action. Only if the focus of the reform exercise is distortion by industry would the ERA-generated information be particularly useful. On the other hand, the ERA-type information would mask the impacts of individual policies that are highly distortionary but offsetting.

A further problem arises in developing aggregate ERA-type indicators if certain seemingly-distortionary policies are put in place to in fact offset market distortions. For example, taxes and subsidies may be used to deal with environmental externalities or to correct market failure for labour force training. If taxes and subsidies were part of aggregate-type assistance

measures, it would be more difficult to determine why seemingly-distortionary policies were put in place. It would likely be easier to determine the rationale behind certain types of assistance if indicators of assistance were available by policy area.

7. Concluding Remarks

OECD (1989b) suggests three broad criteria for determining the types of indicators that may be useful and those which may not be: (1) the theoretical soundness of suggested indicators; (2) the practicality of developing meaningful empirical estimates; (3) and their potential contribution to the process of structural reform. These are the key perspectives from which we may want to discuss the usefulness of ERAs.

On these three criteria, the paper provides the following key conclusions, drawing partly on the Canadian context:

- Theoretically, ERAs may have weaknesses as both indicators of the **level of protection** and good predictors of changes in **resource allocation**. Both these theoretical observations are confirmed by empirical analysis of Canadian protection. These problems with ERAs arises because of: the considerable likelihood, as demonstrated in the case of Canada, of ERP indicators providing unreliable (even perverse) information on the extent of protection and the effect on resource allocation; the difficulty of aggregating information related to different types of assistance; the problem of interpreting aggregate summary statistics, particularly when some seemingly-distortionary policies may have been put in place to deal with market distortions; and, the focus of the reform exercise being on individual policy areas, rather than on industries.

- From the perspective of their contribution to the process of structural reform, by making industry support more transparent, indicators have a useful role to play. The key is to develop right types of indicators that are both analytically sound and increase public transparency.

The analysis in this paper shows that aggregate ERA-type summary indicators may not be as useful as initially thought for two reasons: the conceptual problem in calculating "effective" rates, and the difficulty of aggregation of various policy assistance measures. Given these difficulties, we prefer a mixed approach that is based on using the GE models for policy analysis

and the development of simple summary indicators that are conceptually defensible. In this later context, it may be helpful to individually quantify some key components of ERAs, without at this stage aggregating them. The quantification of these key diverse forms of assistance would be useful in enhancing the transparency of government intervention in the economy, in addition to being useful as inputs into GE models. The list of key forms of assistance that could be quantified includes NTBs, subsidies, tax expenditure and government procurement.

Finally, in developing structural indicators it is useful to keep in mind some of the lessons learnt from the development of macro indicators: first, a range of indicators -- and not one summary statistic -- is needed to understand changes in the macroeconomy, as certain macro indicators can simply not be aggregated (e.g. GDP, inflation, the unemployment rate, the current account balance); a range of policy indicators is needed to understand the role of macro policies (e.g. monetary, fiscal and exchange rate indicators); and, indicators are no substitute for understanding the impact of individual policy change on the economy, which has traditionally required the use of macroeconomic models.

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